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ABSTRACT

The present study states as its purpose the delineation of everyday transactions with the environment of a group of children observed longitudinally in their own homes and neighborhoods from age one to three. This research is considered to have been designed to answer: (1) what types of experiences are intellectually valuable to the young child; (2) whether and when it is important that he construct such experiences for himself as opposed to receiving them from his environment; and, (3) whether and when it is important that he encounter such experiences in context in which he relates to the human in contrast to the non-human environment. Topics addressed are: sources and situations associated with intellectual experiences, the interactor as a source of the child's intellectual experiences, television as a source of the child's intellectual experiences, intellectual competence (tested and spontaneous), the interactor as participator in the child's intellectual experiences, and the process of interaction. It is concluded from the supporting data that the class of intellectually valuable experiences that are observed in this study are more deeply implicated in the child's development of intelligence insofar as this is measured by IQ than other types of everyday experiences, and that it is the incidence and sources of the former type of experience that must be examined in detail if one is to understand how everyday experience becomes the basis for his development of intellectual competence. (Author/AM)

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Predicting IQ from the Young Child's Everyday Experience

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Predicting IQ from the Young Child's Everyday Experiences[1]

Twenty-five years ago Robert White (1959) drew attention to a class of behaviors which he felt were of profound biological significance because they formed "part of a process by which the animal or child learns to interact effectively with his environment." White chose the word "competence" to describe this learned ability to conduct effective transactions with the environment and described competent behaviors as those having an exploratory, experimental character, that are executed with considerable persistence and selective attention to parts of the environment that provide interesting feedback, and that are organized to produce effects on these parts. White deliberately excluded from this class of competent behaviors reflexes and other kinds of automatic responses, well-learned patterns including complex and highly organized ones, behaviors in the service of strongly aroused drives, and random or discontinuous activity. These were not "competent" behaviors in the sense meant by White. Their automatic, routine, or unstructured character made it unlikely that the subject was learning how to deal effectively with his environment.

The aim of the present study was to describe the young child's development of intellectual competence in terms similar to those advanced by White. Its general purpose was to delineate in detail the everyday transactions with the environment of a group of children observed longitudinally in their own homes and neighborhoods from age one to three. The observed experiences of these children were categorized in terms of a system which (1) distinguished experiences considered to be "intellectually valuable" from other types of experiences, (2) distinguished the child's own "competent" behaviors and various environmental inputs as "sources" of intel-

lectually valuable experiences, and (3) distinguished between situations in which the child was relating to his human environment and those in which he was involved solely with his non-human environment. These data permitted us to trace the relationships of intellectually valuable experiences occurring in different situations or coming from different sources to two measures of intellectual competence, namely, the child's spontaneous, intelligent or "competent" behavior and his tested intelligence. Insofar as one may infer probable causes and effects from correlation data, this research is designed to tell us: (1) what types of experiences are intellectually valuable to the young child; (2) whether and when it is important that he construct such experiences for himself as opposed to receiving them from his environment; and (3) whether and when it is important that he encounter such experiences in contexts in which he relates to the human as contrasted to the non-human environment.

Methods

Data Collection. The sample consisted of 23 white children from a variety of social class and ethnic backgrounds who were observed repeatedly in their own homes and neighborhoods between age one and three.[2] Each child was observed for about one hour on three to five separate occasions during each of four periods: age 12-15 months, 18-21 months, 24-27 months, and 30-33 months. The observer began her visits to the home by reminding the mother to follow her normal routine and to let the child do the same. In making an observation the observer used special coding sheets and a stop watch. She observed the child's activities for fifteen seconds, wrote down what she saw during the next fifteen seconds, and continued in this alternating fashion for ten minutes at a time. On a typical visit she completed four ten-minute observations, which were then coded in terms

of a system called the HOME Scale (Watts, Barnett and Halfar, 1972).

Observation Instrument. The principal dimension of the HOME Scale is the Quality of the child's experience. This dimension encoded the observer's judgment of the relevance and value of the child's experience for his development of intellectual competence, and to a lesser extent, for his social development. The content or topic of the child's experience was the major criterion used in making this judgment. Four types of experiences were judged to be intellectually valuable because they seemed to provide the child with clear opportunities to learn basic skills and content in four important domains: verbal/symbolic, spatial/fine motor, concrete reasoning, and expressive/artistic (see Table 1 for examples). The source of these intellectually valuable experiences might be the child's own active "competent" behavior or an environmental input to which he was attentive.

In the first type of experiences--experiences relevant to verbal and symbolic learning and the acquisition of novel, non-routine information--the child's own behavior or the environmental input provided evidence that the child was learning to recognize, understand or use labels, grammatical forms, basic symbols such as letters and numbers, and two-dimensional representations of objects and events as in picture books. Typically, the child was engaged in labeling objects, counting, reciting nursery rhymes or children's songs, or "reading" books, or he was attentive to another person or a television character who was doing these things.

In the second type of intellectual experience--perceptual, spatial, and fine motor experiences--the child's own behavior or the environmental input suggested that he was learning to make perceptual discriminations such as those involved in matching, distinguishing or ordering objects by size, shape, color or position; or

learning about other spatial concepts such as angles and perspectives. In this category of experience the child was typically engaged in tasks of fitting, stacking, building, modeling, tying, or matching objects, and was often using materials especially designed for such activity, such as puzzles, shape-boxes, nesting cups, blocks, tinker toys, scissors, crayons, and lotto cards. Or he might simply be attentive to another person or a television character doing these things.

In the third type of intellectual experiences, those labeled "concrete reasoning", the child's own behavior or the environmental input indicated that the child was likely to be learning basic reasoning and problem-solving skills such as those involved in finding out how mechanisms work or differentiating means from end and cause from effect; or learning about physical principles such as object permanence, conservation, volume, gravity, momentum, buoyancy, trajectory, equilibrium, reflection; or learning about concepts of order, classification and relationship (other than those involved in perceptual, spatial and fine motor experiences). In this type of experience, the child was typically engaged in "scientific experiments" with objects that sailed or sank, objects that plummeted or floated gently to the ground, objects that held more or less liquid, objects that cast shadows or provided reflection, and mechanisms that worked in interesting ways. His focus seemed to be on understanding basic physical regularities and relationships through varying his own actions on appropriate objects or noticing these as they occurred. As in other types of intellectual experiences, the source of the concrete reasoning experience might also be the behavior of another person or television character whom the child observed.

In the fourth category of intellectual experiences--those related to expressive/artistic/imaginative activities--the child's own behavior or an environmental

input suggested that he was likely to be learning artistic skills, or how to express himself imaginatively. Typically he was involved in make-believe with toys, or in role play, or in making representational products such as painting a monster or building a sand castle, or in expressive activities such as playing a musical instrument or singing a melody. If he did not engage in these activities himself, then he observed another person or a television character performing them.

It must be stressed that intellectually valuable experiences did not necessarily involve "lessons" or the use of "educational" materials. On the contrary, an intellectual experience might occur in any context of activity so long as the content of the experience related to one of the four categories previously discussed. Indeed, one of the more challenging of the observer's tasks was to be alert to intellectual experiences arising in mundane unstructured contexts which no one had planned as learning experiences and in which neither instruction nor educational toys were evident.

Only a minority of experiences of one- and two-year olds were judged to be clearly intellectually valuable on the basis of the content criteria referred to above. The majority were considered to be of less clear intellectual value, their content being relevant to one of the categories listed and exemplified in the second cluster of experiences in Table 1. Of these categories the most frequently used by observers were varieties of play-exploration with toys, household objects, natural objects; routine talk; basic care activities; and gross motor activities. Beyond content, the basic process difference between these experiences and those considered to be clearly intellectually valuable concerns the more automatic, routine, unfocused and unorganized character of the child's or other person's behavior.

Sources and situations associated with intellectual experiences. A major aim of the study was to trace the relationships between the child's observed and tested intellectual competence and intellectually valuable experiences occurring in different situations and generated by sources intrinsic and extrinsic to the child. Four everyday situations in which intellectual experiences occurred were distinguished: the child interacting with another person, the child observing another person who was not interacting with him, the child in solitary play, and the child watching television. The first two of these are situations in which the child is relating to the human environment, whereas the last two are situations in which he is involved solely with the non-human environment. Two major sources of intellectual experiences were also compared. The first was the child himself when he constructed intellectual experiences through his own competent behavior. The child could be the source of his intellectual experience in any of the four situations referred to above. The second source of intellectual experiences was human and non-human environmental inputs to which the child was attentive. These inputs varied with the four situations.

The child's behavior as a source of his intellectual experiences. The child's behavior was judged to be a source of his intellectual experience when three conditions were met: the child played an active role in the experience, the inferred topic of his activity was intellectual (in the sense defined in the discussion of content criteria above), and the process aspects of his behavior indicated that he was dealing effectively with the environment, that is, his behavior was "competent". The criteria for judging competent child behaviors are set out in Table 2. As in Robert White's analysis (1959) discussed in the introduction to this paper, these criteria have to do with the child's selective and directed attention to aspects of the environment that produce interesting feedback, the

systematic organization of his behavior toward some end, the varying of his actions on objects as if to understand their fundamental properties, the ordering, sequencing, and classification of materials as if to grasp their similarities and differences, the expression of new, difficult or imaginative ideas, the struggle to find solutions to problems, and the mastery of verbal and motor skills.

The cluster of competent child behaviors in Table 2 is contrasted with a class of behaviors that were more routine or unstructured and were judged to involve less productive transactions with the environment. Thus, the child's behavior was considered routine rather than "competent" when he carried out a well-learned pattern of sequenced steps, when he merely requested routine information, made run-of-the-mill comments, engaged in relatively simple exploration or in routine motor activity, was passively attentive to incoming information, or simply seemed to be marking time. Intellectually competent and routine/unstructured behaviors are also distinguished in Table 2 from a cluster of socio-emotional behaviors. These behaviors were only coded when the socio-emotional aspect of the child's behavior was particularly salient as when the child was clearly trying to get someone's attention, was expressing or receiving affection, or was engaged in social-physical games as in bouncing on his mother's lap or roughhousing.

The distinctions between competent, routine or less competent, and socio-emotional child behaviors are perhaps best conveyed by concrete examples in which the child uses the same basic materials--a set of small animal toys--but in quite different ways.

Competent behaviors (S is source of an intellectual experience)

S moves toy animal about. S announces: "This is a horse, but this is a zebra because it has lines." (Verbal/symbolic content; S makes a verbal distinction)

S lines up toy animals in decreasing order of size. (Perceptual, spatial, fine motor content; S organizes materials, constructs a product)

Less competent behaviors (S is not a source of an intellectual experience)

S puts away the toy animals in her toy box. (Play work involving executive skills; S carries out a well-learned pattern of steps)

S moves the toy animals about. S: "I have lots of animals." (Routine talk; S makes routine comment)

S plays with toy animals, shaking, squeezing, and mouthing them. (Play with toys; simple exploration)

S and friend play at tickling each other with toy animals. (Social-physical game; S engages in game for sheer enjoyment)

The examples given above highlight the occasions when the child's own behavior can be judged to be the primary source of his intellectually valuable experiences. However the child also encounters a great many experiences which may also be considered intellectually valuable although his own behavior is less than "competent". In these experiences another person or thing in the child's environment provides the content that warrants the judgment that the child's experience is intellectually valuable. In this study three types of environmental inputs were found to occur fairly frequently. In the interactive situation this input came from the interactor, in the people-watching situation it came from the behavior of the person whom the child observed, and in the television-watching situation it came from the television program. In the interactive situation there was also the special case of true reciprocal interaction in which both the child's and the interactor's behavior met the criteria for providing the child with an intellectual experience. In other words, if the child's behavior were considered alone he would have been judged the source of the intellectual experience, and if the interactor's behavior were considered alone, he would have been judged to be the source. In such cases, the child and the interactor were judged to be joint sources of the

child's intellectual experience.

The interactor as a source of the child's intellectual experiences. For the interactor to be judged as the sole or joint source of the child's intellectual experiences, four conditions had to be met: the child's behavior was judged as other than competent, the content of the interactor's behavior was intellectual, the child was attentive to the interactor's behavior and the interactor used a "participatory" technique of interaction. An interactor was thought to use a participatory technique when he taught the child, entertained him, joined in an activity with him, helped him perform an activity, or talked to him about it. The common feature of participatory techniques was that the interactor actively took part in an experience that might be judged to be intellectually valuable or not for the child. Here are two examples of another's use of a participatory technique. In the first the mother is the sole source of the child's intellectual experience, whereas in the second she and the child are judged to be joint sources.

> M labels the pictures on S's pajamas, "cow", "horse", "elephant". S listens attentively. (M is source of intellectual experience; S's behavior is routine; M's technique is participatory)
>
> M labels the pictures. S repeats "cow", "horsie", "elephant" in response. (M and S are joint sources of intellectual experience; S's behavior is competent, M's technique is participatory)

The non-interactor as a source of the child's intellectual experiences. A person whom the child observed but who was not interacting with him was considered to be the source of the child's intellectual experience if three conditions were met: the child's behavior was judged as other than competent, the child was attentive to the other person's behavior, and the content of that behavior was intellectual. Here is an example of a people-watching situation in which the other person's behavior is judged to be the source of the child's intellectual experience.

S observes his big sister conducting a flotation experiment, dropping heavy and light objects into a bowl of water to see which ones will float. (Sister is source of intellectual experience)

Television as a source of the child's intellectual experiences. The behavior of a television character (or other aspects of a television sequence) was considered to be the source of the child's intellectual experience if three conditions were met: the child's behavior was judged as other than competent, the child was attentive to the program, and the content of the program was intellectual. Here is an example of television-watching in which the television program is judged to be the source of the child's intellectual experience.

Television character shows difference between circle and square, pointing to their contours. S listens attentively. (TV is source of intellectual experience; S's behavior is routine)

Reliability of observers. Two forms of agreement were checked to establish reliability of the HOME Scale: inter-observer agreement (between two observers making simultaneous observations on the same child), and inter-coder agreement (between two coders coding the same observation made by the third observer). For the inter-observer reliability check the three observers were paired with each other and each pair simultaneously observed six Ss for 40 minutes apiece. Inter-observer agreement for each item or cluster of items of each dimension was then checked for each unit and the total agreement calculated. In the inter-coder reliability check each pair of coders coded 16 observations on 16 different Ss originally made by the third observer, 4 at each period. For each reliability check scores for major items summed across observations coded by one observer/coder on a given S were correlated with the corresponding scores of the other observer/coder, and correlations for the three pairs were averaged. Agreement between observers/coders was high. For example, the correlation between observers' scores was .97 for intellectually valuable experiences, between .92 and .95 for each of the four situations, and between .76 and .96 for each source of intellectual experience.

Intellectual competence: tested and spontaneous. Two types of measures of intellectual competence--tested and spontaneous--were obtained for each child toward the end of his third year. At 36 months the test measures were the Stanford Binet and tests of Receptive Language and Spatial Abilities. The Bayley Mental Scales (1969) were also given at 12 and 24 months and tests of Receptive Language and Spatial Abilities at 12, 15, 21, 24, 27 and 30 months. The latter tests are described in White, Watts et al. (1973).

Intellectual experiences which the child constructed for himself in his solitary play at age 30-33 months was the measure of the child's spontaneous display of intellectual competence. By definition, the child's behavior in such experiences was intellectually competent and his behavior was also spontaneous in that he was not performing for anyone else's benefit (except, perhaps, the observer's) nor was he being helped or encouraged by another. Similar measures of the child's natural expression of intellectual competence were obtained from observations at age 12-15, 18-21, and 24-27 months.

Results and Discussion

Three key questions were investigated in this research: (1) Are certain experiences encountered by the young child in his everyday life more important to his intellectual development than others? (2) If so, does it matter what is the source of these experiences, whether they come to the child from human or non-human environmental inputs or whether he constructs them for himself through his own active, intellectually competent behavior? (3) If certain sources matter more than others, is the question of timing important?

The results of this study suggested clear answers to each of these questions. First, they demonstrated that a class of observed experiences that we had deemed

a priori to be intellectually valuable to the child were indeed so, at least insofar as their correlation with IQ and other test scores is evidence of their intellectual value. These experiences were considered intellectually valuable because they seemed to provide the child with clear opportunities to learn verbal/symbolic, spatial/fine motor, practical reasoning, and expressive skills or content that are considered variously by psychologists, educators, test-constructors and laypeople to be important intellectual achievements for a young child. This category of intellectually valuable experiences was distinguished from nine other types of everyday experiences, including simpler, unstructured, unfocused play, which were thought to offer less clear opportunities for the child to master intellectual skills or content.

The validity of this distinction was demonstrated by the increasingly large differences between high and low IQ children in the number of intellectually valuable experiences they encountered from age one to three and by the contrasting correlations with their Binet IQ's at age three of intellectual and non-intellectual experiences. Children with high Binet IQs ($\geq$110, the sample mean) had many more intellectually valuable experiences ($F=2.80$; $p < .01$) than children with average-low IQs ($<$ 110), the absolute difference between the groups increasing sharply as the children grew older (F, Group X Time = 5.30; $p < .01$). Thus, the means for the two groups on percent of observation units spent in intellectually valuable experiences are 11% versus 7% at 12-15 months; 21% versus 14% at 18-21 months; 28% versus 15% at 24-27 months; and 42% versus 20% at 30-33 months, roughly a ratio of 2:1 in favor of the high IQ children. The divergence between the two groups over time is underscored by the finding that the 20% figure finally reached by the average-low IQ group at 30-33 months is already surpassed by the high IQ group one year earlier, at 18-21 months.

The correlation between various types of experiences and IQ demonstrates these contrasting patterns even more powerfully. Table 3 shows that only intellectually valuable experiences and preparatory, planful activities are positively correlated with the Binet at age three, whereas all other types of experiences are uncorrelated or negatively correlated with IQ. Thus, the correlation of the Binet with intellectual experiences summed over the four observation periods is .76 ($p < .01$) whereas its correlation with simple exploratory play is .20, with routine talk, -.52 ($p < .05$), and with social games such as roughhousing, -.56 ($p < .01$). We conclude from these and other supporting data that the class of intellectually valuable experiences that were observed in this study are more deeply implicated in the child's development of intelligence (insofar as this is measured by IQ) than other types of everyday experiences, and that it is the incidence and sources of the former type of experience that must be examined in detail if we are to understand how everyday experience becomes the basis for his development of intellectual competence.

This conclusion sets the stage for two intriguing questions. If the child's history of intellectual experiences is important, does it matter whether he constructs these experiences for himself or whether he receives them from his human or non-human environment? If so, is the question of timing important? The answers to these questions have profound theoretical and pedagogical implications. From Piagetian theory and the philosophy behind the open classroom it might be supposed that the child's active construction of his own experiences is central to his intellectual development, passive learning from the environment being relatively unimportant. In contrast, traditional learning theory and traditional classroom practice assumes that the child progresses intellectually by receiving information, by demonstrations, corrective feedback and reinforcement from the environment.

More sophisticated versions of traditional learning theory emphasize the need for structure and appropriateness in environmental inputs and for precisely applied feedback and reinforcement contingencies, but there is not nearly the same stress on the active child fashioning his own knowledge as there is in Piaget's writings (Kohlberg and Mayer, 1972). The Piagetian philosophy is well exemplified by Piaget's claim that to teach a child something is to prevent him from discovering, that is, truly learning it. Learning theorists and traditional practitioners would find this assertion incomprehensible if not preposterous.[3]

The results of this research give some support to both theoretical positions, full support to neither. Briefly, we found that it does matter a great deal how the child's intellectual experiences are derived but different sources of intellectually valuable experiences become important at different periods in the child's life. If one is considering experiences that occur before age two and a half, IQ is much more strongly related to intellectual experiences provided to the child by his human environment than to similar intellectual experiences that the child creates for himself. The earliest intellectual experiences that are correlated with IQ at age three are experiences in which the child interacts with another person, especially experiences in which the interactor is an active, structuring source of the child's intellectual experiences. It is not until the child is 30-33 months old that intellectual experiences that he fashions for himself through his own competent behavior begin to be significantly correlated with his IQ. Further, insofar as they are related to IQ, the child's ability to generate his own intellectual experiences at age 30-33 months itself seems to be rooted in his prior intellectual experiences with real people. We stress "real people" because at no stage did intellectual experiences provided by television -- even by highly appealing educational programs such as Sesame Street -- seem to have a significant impact

on the child's IQ.

These conclusions were consistently supported by three types of data analyses, analyses of variance comparing high and low IQ children on various sources of intellectual experiences (Table 4), simple correlations between sources of intellectual experiences and IQ (Table 5), and multiple regressions with sources of intellectual experiences as predictors of IQ at age three (Figure 1). All three types of analyses demonstrate that interactive intellectual experiences, especially those in which the interactor plays a critical role in structuring the child's experience, are related to IQ at age three at an earlier stage than self-generated intellectual experiences (experiences that the child creates for himself). Consider first the results of the analysis of variance. The t means and values of Table 4 show that high IQ children encountered about twice as many interactive intellectual experiences as average-low IQ children from the first observation period (12-15 months) onward. In contrast, it was not until the third period (24-27 months) that the two groups diverged significantly in intellectual experiences generated by the child for himself in his solitary play. In other words, the child who was to earn a high Binet IQ at age three seemed no more intelligent than his average-low IQ age-peer when he was under age two, if we judge his intelligence by his solitary play activities. He was nevertheless enjoying a strong advantage. At least during his second year of life, if not before, the first child received twice as much intellectual stimulation from the people around him as the second child, and this advantage continued throughout his third year while his own ability to create intellectual experiences for himself gradually developed and came to surpass that of the second child.

This pattern of effects is also clearly demonstrated by the correlations between various sources of intellectual experiences and IQ. Table 5 shows that

the earliest sources of intellectual experiences that are correlated with IQ are those in which an interactor is either the sole or joint source of the child's intellectual experience. Substantial correlations with sources involving the interactor occur as early as 12-15 months and significant ones are found at 18-21 months. Then, starting at about age two a second source of intellectual experiences becomes salient. This source is the behavior of another person whom the child merely observes engaging in intellectual activities but who is not interacting with him. It is only after correlations with these two sources of intellectual experiences involving the human environment have emerged that the intellectual experiences that the child creates for himself in solitary or in interactive situations begin to be significantly correlated with his IQ.

The results of this simple correlational analysis thus suggest a definite sequence in which intellectual experiences in which another person plays an active, structuring, even a dominant part are the ones that show an early and continuing relationship to the child's IQ at age three. In contrast, similar experiences that the child fashions for himself when he is under two-and-half apparently have little to do with his later IQ test performance. Evidently, it is only after he is over two-and-a-half years old that the intellectually valuable experiences that he creates through his own intelligent behavior in his normal everyday environment correlate with his performance on the Binet at age three.

The above two techniques of analysis of variance and correlation analysis happily demonstrate similar results. However, each technique is less than ideal for analyzing the data. The correlation analysis can indicate that a certain source of intellectual experiences is related to tested intellectual competence at a certain observation period, but from these zero order correlations one cannot infer whether or not one source is more highly related across periods to IQ than

another source. The analysis of variance can overcome this restraint and look not only at the relationship between IQ and sources at each observation period but also the relationship between a particular source and IQ across observation periods. However, the analysis of variance has a serious drawback in that it forces us to make an arbitrary division of high IQ and average-low IQ subjects. To perform this analysis we have to treat all subjects within a group as if they had the same IQ score, ignoring large within-group variations in IQ that may prove to be related to particular sources of intellectual experiences.

Because of the deficiencies of these two methods, we used yet a third procedure, regression analysis, for comparing the relationships over time between IQ and sources of intellectual experiences. Figure 1 provides the results of a regression in which the effects of two sources of intellectual experience are compared, namely the child in solitary play (Sol-C) and the interactor (Int-I) as an active generator of the child's intellectual experiences. These two sources are theoretically the most contrasting of the six sources distinguished in this study in that in the first the child creates his own intellectual experiences (he is alone) whereas in the second it is the interactor who provides him with intellectual experiences since the child's own behavior is not "intellectually competent" in the special sense defined in this research.

Figure 1 shows how the proportion of IQ variance (R^2) at age three explained by these two sources increases as the sources are alternately introduced into the regression over time. In this analysis the sources are introduced in pairs with the child as a source being entered <u>before</u> the interactor at each observation period and with observation periods ordered chronologically.[4] One striking feature of the results is the sheer predictive power of the two variables. Sixteen percent of the variance in IQ at age three can already be predicted from intellectual

experiences generated by only these two sources at age 12-15 months. By 18-21 months this prediction increases to 38%, by 24-27 months it climbs to 63%, and by 30-33 months it reaches 69%, an impressively high figure given the reliabilities of the measures. More pertinent to the present argument is evidence on the relative power of child and interactor as sources of experiences predicting IQ. The results are clear cut. About 50% of the variance in IQ at age three can be attributed to intellectual experiences progressively provided by the interactor over the preceding two years, and only 19% to similar experiences that the child creates for himself. Up until age 24-27 months, the behavior of the interactor is a much more powerful predictor of the child's IQ than the child's own behavior. This pattern seems to change at 30-33 months when the child as a source becomes the more powerful predictor. But by this time 63% of the variance in IQ can already be predicted from intellectual experiences occurring in the previous three periods, and the increase in the prediction of IQ, although mostly attributable to the child as a source, is relatively small (R^2 increases from 63% to 69%).

The evidence of the multiple regression thus suggests that the strong relationship between the child's solitary self-generated intellectual experiences at 30-33 months and IQ that consistently emerged in the analysis of variance and simple correlations is misleading. The more precise multiple regression procedure indicates that the independent predictive power of the child's solitary self-generated intellectual experiences is quite small. Most of the relationship existing between the child's self-generated intellectual experiences at 30-33 months and IQ at 36 months seems in fact to be attributable to the child's prior history of encounters with people who take the time and have the skill to interact with him in intellectually stimulating ways.[5]

The Interactor as Participator in the Child's Intellectual Experiences

To understand why early interactive intellectual experiences should play so critical a role in the child's intellectual development it is essential to remember how an interactor comes to be judged as a source of the child's intellectual experiences in this research. An interactor is considered to be the primary or joint source of the child's intellectual experiences only when he uses a participatory technique of interaction. The specific techniques defined as participatory include teaching, helping, entertaining, conversing and sharing in the intellectual activity like a playmate. The common feature of these techniques is that the interactor plays a direct, active, and integral role in creating, guiding and expanding the child's intellectual experience. The interactor is responsible either solely or jointly with the child for the manifest intellectual content of the experience. His behavior is not merely facilitative (in the sense, say, of supplying needed materials), or reinforcing (in the sense, say, of praise or approval), or incidental to the intellectual experience. Rather, the interactor's behavior literally creates or helps to create the intellectual content. This content is often judiciously chosen, well structured and attractively presented. But the same or better can be said of certain children's television programs, the watching of which, in this research, seemed not to relate at all to the child's intellectual development. What seems to distinguish these two types of environmental inputs are two features that are highly salient in the interactor's behavior and seldom present in television programs. These are the individualized and responsive quality of the interactor's behavior and its affective subtext.

When an interactor engages in an intellectual activity with a child he typically tailors his input to the individual child's needs. He tries to match its content and style to what he knows of the child's capabilities and interests. He

is responsive to questions, problems, inadequacies in the child's understanding. His behavior is geared to the particular not the average child. When this interactor is a parent who is in intimate contact with the child on a day-to-day basis, the potential power of such individualized treatment hardly needs further commentary.

An important, related aspect of the interactive situation is that it often links three distinct sources of intellectual experiences. Although for purposes of analysis we distinguish these three sources (the interactor, the interactor and child jointly, the child), in practice such experiences often occur as parts of a larger interactive sequence. The first two sources of experience were the ones that showed the earliest and most stable relationship to the child's intellectual competence, but it seems likely that the third type of experience (in which the child is the source and the interactor the approving but basically "non-contributing" partner) is an essential link to the child's later ability to generate intellectual experiences in his solitary play. Put more concretely, the child in this type of interactive situation is practicing the art of creating intellectual experiences for himself in the presence of an approving interactor who a minute before may have provided the model for his intellectually competent behavior. It is not unreasonable to suppose that these practice experiences make him more likely to engage in similar behavior when the interactor is no longer present.

This point brings us to the affective aspect of interactive experiences. By the very fact of sharing in intellectual experiences with the child the interactor conveys that such experiences are valued and pleasing. It is not necessary that the interactor express approval or affection overtly. The essential message is already transmitted by the sheer fact that the interactor participates positively in the experience. When this interactor is a parent, a sibling or a friend to whom

the child is emotionally attached, it seems very likely that the child will come to value and engage in such activities for the simple reason that these are the ones that people he likes prefer. When, for example, the interactor chooses to read a book to the child rather than to roughhouse with him, the child comes to understand what the other person's system of values is, and, trite though it may seem to say it, he will tend to reflect those values in his own self-directed activities.

The Process of Interaction: Some Concrete Examples

It may not be easy for a reader to visualize from this abstract discussion what the process of intellectual exchange between a skillful interactor and a child actually looks like. The picture that comes to mind most readily is of an adult humorlessly pushing the child to achieve and forcing pre-packaged information on him willy nilly. This picture is entirely incongruous with our observations, but it is not an uncommon reaction to the labels that we have chosen to use in our conceptual system. In this section therefore we shall try to bring to life process of intellectual exchange that we call an "intellectually valuable interaction". We shall do this by presenting a series of excerpts culled from our actual observations of young children's experiences.[6]

The interactor as teacher. The first two examples depict the interactor as teacher. The first portrays a fairly conventional teacher-pupil relationship, the mother playing the role of transmitter of knowledge and skills. The next excerpt shows a more subtle process at work. Here there is a conceptual problem that clearly seems to challenge the child, and the interactor's teaching skill consists of being able to cue into the child's concerns and to do something that helps him solve his problem through reorganizing his current mode of thinking.

First, the more conventional example.

Mother is arranging some flowers in a large vase. Janie (age 32 months): "Let me take one, Mommy." Mother suggests: "Why don't you smell this?" and puts a carnation to Janie's nose. Janie sniffs, smelling the flower. Mother: "These are carnations. Not much of a smell. And those are chrysanthemums." Janie looks on, solemnly taking it all in.

This conventional, though apparently effective teaching technique, may be contrasted with the following more unusual one.

Father is reading to John, age 33 months, Ezra Keat's story "Goggles". They turn to a picture showing the dog Willy running away with the goggles through a hole in a fence. In the picture the dog's face is half hidden behind the fence. John looks and tells Father: "Doggie face broken." Father explains: "No, it's not broken. It's hiding behind the fence." John looks puzzled. He asks: "Hiding?" Father demonstrates: "See my hand? Now, see it hide when I move it behind the book?" John watches intently. Father continues: "Now, see it come out again. It's not broken. It was hiding." John imitates Father's action several times, passing his hand behind the book and watching it reappear.

The interactor as entertainer. For some adults, especially those with the performer's instinct, the most pleasurable way of participating in intellectual activities with a child is to entertain him. Dramatization of stories, role playing, singing, dancing, strumming a guitar are all ways that novel material, original ideas, as well as skills involving the mastering of set sequences can be delightfully imparted. Consider Nancy's experience:

Nancy (age 30 months) calls to her mother: "Find me. I'm hiding." Mother tells her "all right" and walks over to the closet where Nancy is standing in full view. Mother call out in mock distress: "Oh dear, I can't find my Nancy. I wonder where she's gone. Perhaps she's only gone out to buy some bread and milk, but I didn't hear the door. Oh dear, she's just disappeared." Nancy is chortling with delight. Mother pulls back the clothing and looks in at Nancy. She shakes her head and says: "I guess she isn't here. There is a little girl here but her name is Mary. I still don't know where Nancy has gone." Nancy laughs and hides her eyes (presumably so her mother will not be able to see her!). Nancy continues chortling as Mother plays variations on the theme of "Where has Nancy gone".

The interactor as playmate. Closely allied to the interactor's role as entertainer in terms of willingness to do "childish" things is his role as the

child's playmate. Here, however, the interactor is not so much on the stage as on the floor. His role as playmate calls for getting down to the level of the one- to three-year-old and pitching into his childish but intellectually important activity. Here is an excerpt that captures the child-like, reciprocal, playful character of this role performed in the context of activities that are clearly of intellectual value to the child.

> Mother and Jamie (13 months) are sitting on the floor. Jamie sees a little wooden pig lying on the floor. He picks it up and hands it to Mother calling, "Piggy, piggy." Mother asks, "Shall we hide the piggy?" Jamie smiles. Mother tells him, "I think your piggy is too big to fit under the cup. I'll get something to hide the piggy under." She shows him that the cup is too small. "See, your piggy sticks out. It can't hide under there." Mother goes to the kitchen and returns with pans for a three-tiered cake. Mother hides the pig under the largest pan and places the others on top in a tower. Jamie smiles and immediately takes down the pans one by one and uncovers the pig. He laughs and Mother claps, "Terrific." Jamie then covers the pig with the pan, but immediately uncovers it and grins. Mother: "Hey, you found the piggy. Hide him again." Jamie covers the toy pig and looks at Mother. Mother asks, "Well, where did that piggy go?" Jamie takes off the pan and giggles. Mother claps, "There he is. Hurray for Jamie. Jamie found the piggy."

The interactor as converser. The participatory role that comes most easily to many adults is that of the conversation partner. One can chat to a child while doing the ironing, or eating lunch, or walking to the bus stop. But only certain forms of conversation are thought, in this research, to create an intellectually valuable experience for the child. These include the use of language to teach (e.g. labeling objects or events or by expanding a child's statement into a structurally more complete form); to convey novel information; to make comparisons, contrasts and classes; to explain; to revive past experiences; to anticipate future events; or to evoke a poetic or imaginary world. Many examples of this use of language occur in our observations as in the following excerpt:

> Mother and Sonja, age 2, are in the living room where Mother is about to blow up a balloon. Sonja says something to Mother about a circus. Mother tells her: "No, you didn't go to the circus--you

went to the parade." Mother asks: "What did you see?" She thinks a moment and then shouts: "Big girls!" Mother smiles: "Big girls and what else?" Sonja says: "Drums!" and laughs. Mother asks: "What made all the loud noise at the end?" Sonja answers: "Trumpets." Mother tells her: "Yes, and fire engines. Do you remember the fire engines?" Sonja nods: "You hold my ears a little bit." Mother smiles: "Yes, I did, just like this," and puts her hands on Sonja's ears. Sonja laughs.

The interactor blends his roles. We have methodically exemplified the several participatory roles that interactors play in their young children's intellectual experiences and yet we have not captured the essence of the part. The fault, we think, lies in compartmentalizing the roles for analytic presentation as if in real life they stood apart from each other. In fact, the most striking feature of the behavior of the effective participator is a remarkable blending of these roles. Read almost any of the excerpts that we have given under the four separate headings and the reader will find that many roles are combined in a single episode. The skillful participator shifts from one to another blurring the lines of demarcation so much so that the ability to vary one's approach seems the quintessence of the part.

In our writings we have often used a metaphor of the theatre in describing the art of effective participation, and for good reason. Just as the skill of a good actor cannot be reduced to separate, quantifiable components, so too the art of stimulating and sustaining a child's intellectual interests cannot be captured by a formula. In the next excerpt, when we see Matthew's mother play an imaginary badminton match with her son, she is teacher, entertainer, conversation-partner, and playmate all at the same time. Her roles are not blocked out in segments. They are combined and interwoven in a creative whole bound together by the mother's exquisite sense of her son's interests and capabilities.

Matthew (age 26 months) comes into the kitchen holding a child-size badminton racket. Matthew swings the racket. Mother: "Did you get it? Where did it go? Down there?" Matthew: "I got it!"

and runs out of the kitchen after an imaginary shuttlecock. (Apparently, Mother and Matthew have played this game before, since her words are immediately taken as a signal to start the make-believe game.) Matthew swings the racket hitting the imaginary shuttlecock. Mother pretends to toss the "shuttlecock" back to Matthew. They continue, Matthew and Mother taking turns hitting the "shuttlecock".

The game continues, becoming more sophisticated. Matthew seems to be timing his imaginary shots to follow Mother's and looks up at the imaginary "birdie" each time it approaches. Matthew inadvertently drops the racket. Mother: "You lost your racket." Matthew: "Oh, I missed!" (As if dropping the racket really did cause him to miss the imaginary shuttlecock.) Matthew runs to the hallway and retrieves the "birdie". Matthew pretends to serve and Mother to return the serve. Matthew retrieves the imaginary shuttlecock from the hallway. They continue. Matthew calls: "Enough, enough!" ... Matthew: "I want a drink of water." Mother gets a glassful: "Are you thirsty?" as she holds the glass for Matthew to drink.

This excerpt captures as beautifully as any we have seen what we mean by a mother's active participation in her young child's intellectual experiences. Remember that Matthew is only 26 months old and has probably never seen a badminton match. Think of the imagination and skill it requires of Matthew to synchronize his movements with his mother's, to anticipate the trajectory of the imaginary shuttlecock, to retrieve it when he has miscalculated, to reason that if he dropped his racket during the approach of the shuttlecock then he can't have been able to hit it. Think too of the imagination and skill it requires of Matthew's mother to inspire this performance, making their tournament ever more challenging until, at last, Matthew staggers from the court begging for a glass of water much like a tennis player after a grueling match!

Matthew's experience is profoundly intellectual, his mother's behavior truly educative. She challenges Matthew to perform by performing herself; she inspires him to create wonderful images by creating them herself; she excites and pleases him by being excited and pleased herself. Like an actor at one with his audience, she closes all psychological distance between herself and Matthew. Intellectually and emotionally, they have interacted.

Footnotes

[1]Briefer versions of this paper entitled "Observed intellectual competence and tested intelligence: their roots in the young child's transactions with his environment" were read by the senior author at the Annual Meeting of the Eastern Psychological Association, New York City, 1975, and at the Biennial Meeting of the Society for Research in Child Development, Denver, Colorado, 1975. Itty Chan and Christine Halfar collaborated closely with the author in carrying out this research and should be considered "silent authors" of this paper.

[2]Fifteen Sr in this sample were included in a study described in White, Watts et al. (1973) in which the present authors analyzed only the child's interactive experiences with people. Their data were recoded for this study in terms of the HOME Scale which was applied to all of the child's experiences, not just his interactions with people.

[3]In some of his writings (e.g. Piaget, 1951), Piaget has referred to the essential role of the social environment in the child's construction of cognitive concepts. But he has given relatively little attention to analyzing it in detail.

[4]A multiple regression was also calculated in which the interactor as a source of intellectual experiences was introduced into the regression before the child. The results of this regression favored the interactor as a source slightly more than the present results.

[5]More detailed descriptions of these results and of the relationships between intellectual experiences and the child's observed intellectual competence may be found in a monograph now being prepared by the senior author.

[6]Much more detailed descriptions are to be found in Carew, Chan and Halfar (in press) from which these excerpts were taken.

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Table 1

Categories of Experience in the HOME Scale

Experience	Focus	Example
1. Intellectually Valuable Experiences		
Verbal-symbolic learning	Acquisition of verbal skills.	Mother reads words "school bus" on the toy bus. S repeats "school bus".
Spatial-fine motor learning	Differentiation in perception or motor coordination.	S fits toy figures in holes in the bus and turns them all to face the front.
Concrete reasoning	Concept formation or investigation of physical laws.	S makes an incline with a sofa cushion and lets the bus roll down from the top several times. Mother comments: "It goes all by itself on a hill, doesn't it?"
Expressive	Expression of imagination or creation of representational products.	S creates dialogue for imaginary children on the school bus.
2. Intellectually Less Valuable Experiences		
Play	Investigation and undifferentiated use of toys, household objects or naturally occurring materials.	S scoops some dirt into the back of a toy truck and pushes the truck along the ground.

Experience	Focus	Example
Play-work involving executive skills	Carrying out of patterned sequences.	S and mother put toys away in the playroom, placing some on shelves and some in the toy box.
Conversation	Gaining routine information.	S listens to mother talking on the telephone. Mother tells him: "Grandma's coming to see us."
Gross motor learning	Acquisition of gross motor skills.	S climbs up and down the stairs.
Basic care	Satisfaction of physical needs.	Mother diapers and dresses S after his lunch.
3. Socio-emotional Experiences		
Positive emotion and social games	Expression of affection or pleasure.	S smiles and kisses baby sibling.
	Socio-physical games or playful teasing.	S laughs as mother bounces her on her knee.
Social contact, attention, and distress	Seeking another's attention for its own sake.	S smiles shyly at visitor and walks after him when he and father leave the room.
	Demanding another's attention.	S sees sibling showing mother a drawing. S shoves her own drawing in mother's face and shouts "Look at mine!"
Preparatory	S prepares for an activity.	S lines up a set of blocks (later she builds with them).

Experience	Focus	Example
Discouraged	S is discouraged or restricted from undertaking an activity or is punished or scolded for doing it.	S plays with pots and pans. Mother scolds her for making a mess.

Table 2

Criteria for Judging the Child's Behavior as Competent

Type of Child Behavior	Behavior	Examples
Competent		
Verbal	S expresses complex idea.	S answers M: "Apples grow on apple trees and carrots grow in the ground."
		S tells peer: "Jenny-penny. I made your name rhyme."
	S expresses imaginative idea.	S says about a drawing: "This is a bubble that didn't pop yet and this one did."
		S, carrying a handbag: "I'm going to the store to get cookies."
	S tries to master a verbal skill.	S walks along a row of alphabet posters identifying the letter and picture for each, occasionally making mistakes.
		S repeats "rhinoceros" after mother, concentrating on sounding each syllable.
Fine motor	S constructs a product.	S builds a block tower and a low structure nearby.
	S conducts an experiment.	S fills three small bottles with water and then pours each into a larger bottle.

Type of Child Behavior	Behavior	Examples
	S tries to master a fine motor skill.	S puts snap clothespins around the edge of a pail, takes them all off and then replaces them.
Gross motor	S tries to master a gross motor skill.	S hits a ball with a hockey stick from one end of the hallway to the other.
Less Competent		
Verbal	S makes a routine statement.	S tells mother she will slide down the slide when they get to the playground.
	S asks a question.	S asks sibling: "What's that for? What are you making?"
Fine motor	S carries out patterned sequence that is routine.	Mother asks S to empty ashtray. S promptly carries ashtray to wastebasket and returns to mother.
	S explores the qualities of an object.	S strokes, pats andpokes at the family cat.
	S engages in routine or undifferentiated activity.	S carries a toy car across the room, then kneels and pushes it along the floor.
Passive-attentive	S listens and/or looks attentively.	S looks on as mother repairs sibling's roller skate.

Type of Child Behavior	Behavior	Examples
Passive-Inattentive	S wanders about and/or gazes vacantly.	S stares absently across the room and picks at the edge of his blanket.
Social	S expresses affection.	S runs to mother and hugs her.
	S expresses delight in social-physical play.	S shrieks with laughter as she runs from sibling.
	S expresses dependency or seeks social contact.	S follows after mother when she leaves the room.
	S demands attention.	S shouts sibling's name when sibling does not respond to S's tug on his sleeve.

Table 3

Correlations between Experiences and IQ at 36 Months[a]

	Observation Period in Months				
Experience	12-15	18-21	24-27	30-33	All[b]
Intellectual	.43*	.47*	.52*	.72**	.76**
Talk			-.41	-.59**	-.52*
Gross motor				-.51*	-.40
Social games		-.49*		-.53*	-.56**
Attention seeking		.38			
Preparatory	.59**	.46		.42	.71**
Discouraged					-.44*

$n = 23$

[a]Only correlations $\geq .35$ are given. Experiences for which no correlations were $\geq .35$ are not listed.

[b]Experiences summed over four observation periods for each S.

*$p < .05$

**$p < .01$

Table 4

Proportions of Time Spent by Children with High and Low-Average IQs on Intellectual Experiences Derived from Different Sources[a]

Situation[d]	Source	IQ	Observation Period (Months) 12-15	18-21	24-27	30-33	F^b Groups	F Time	F G X T	t^c 12-15	t 18-21	t 24-27	t 30-33
Solitary	C	H	.036	.065	.106	.125							
		L	.030	.051	.067	.040	8.88**	10.28**	3.85*	0.68	0.94	1.79*	4.68**
Interactive	C	H	.014	.018	.021	.028							
		L	.005	.014	.013	.015	8.07**	2.40	0.37	2.01*	1.03	1.32	1.83*
Interactive	C/I	H	.016	.036	.042	.062							
		L	.007	.016	.024	.031	12.92**	7.75**	0.76	1.72	2.80*	1.90*	2.18*
Interactive	I	H	.026	.036	.036	.043							
		L	.011	.022	.013	.029	5.63*	3.37*	0.31	2.44*	1.65	3.40**	1.06
Sum Interactive		H	.056	.090	.099	.133							
		L	.023	.052	.050	.070							
People-watching	OP	H	.004	.014	.009	.023							
		L	.005	.009	.005	.009	4.30	4.89**	1.81	0.58	1.43	1.89*	2.03*
TV-watching	TV	H	.000	.017	.037	.108							
		L	.001	.021	.017	.046	1.65	7.53**	1.64	0.82	0.18	1.14	1.64

[a] N for high IQ group = 14, for low-average group = 9. Each mean is an average of individual proportions of observation time spent on the specified situation/source.

[b] The analysis of variances uses unweighted means. Heterogeneity of variance is taken into account by Welch's procedure (Winer, 19

[c] One-tailed t tests.

[d] Situations-sources are: Solitary - C, solitary situation with child as source of the child's intellectual experience; Interactive - C, interactive situation with child as primary source; Interactive - C/I, interactive situation with child and interactor as joint sources; Interactive - I, interactive situation with interactor as primary source; People-watching - OP, people-watching situation with person whom S observes as source; TV-watching - TV, television-watching situation with television program as source.

*$p < .05$

**$p < .01$

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Table 5

Correlations Between IQ at 36 Months and Intellectual Experiences Derived from Six Sources[a]

Situation[b]	Source	Observation Period in Months				
		12-15	18-21	24-27	30-33	All
Solitary	C				.57**	.47*
Interactive	C				.58**	.50*
Interactive	C/I	.39	.57**		.45*	.66**
Interactive	I	.37	.52*	.68**		.60**
People-watching	OP			.48*	.43*	.51*
TV-watching	TV					

[a]Only correlations $\geq .35$ are given.

[b]See footnote d, Table 4.

*$p < .05$

**$p < .01$